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This grant was extremely successful both in developing sensor systems and in educating undergraduate students. There were several reasons to ask students to develop these systems. First and foremost is the educational value of having a student buidl a complete system. This challenge is much greater than a typical course laboratory experiment. The student must propose, refine, and choose among different variants of any particular approach. The system must be designed, built, debugged, documented, and most importantly, evaluated. Any particular version of the system may suggest future revisions or new approaches. In some cases there are commercially available systems the researchers could use, but in many cases they had trouble finding off the shelf systems that are light and inexpensive enough to suit their purposes.

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Final Technical Report: Undergraduate Robotics Projects In Support Of Research On Neural Networks

Grant No. F49620-93-1-0104
1/15/93 - 7/15/93

Christopher G. Atkeson

This grant was extremely successful both in developing sensor systems and in educating undergraduate students. There were several reasons to ask students to develop these systems. First and foremost is the educational value of having a student build a complete system. This challenge is much greater than a typical course laboratory experiment. The student must propose, refine, and choose among different variants of any particular approach. The system must be designed, built, debugged, documented, and most importantly, evaluated. Any particular version of the system may suggest future revisions or new approaches. In some cases there are commercially available systems we could use, but in many cases we had trouble finding off the shelf systems that are light and inexpensive enough to suit our purposes. This is another reason to give the students a relatively free rein and see what they can come up with.

We developed a versatile color vision system that is used to track ground and flying vehicles indoors and outdoors. The design is based on a 68332 microprocessor. The color signal is digitized into R, G, and B values, and those values are used to index an inverse color lookup table. Color values in the table that are tracked are marked, while other color values are not. The 68332 keeps track of where the marked pixels are located in the image. The student who designed this system described it in a recent SPIE conference.

We developed a tracking system with a 30 meter diameter based on tracking of an onboard modulated infrared beacon.

We built and tested a robust altimeter based on sonar that uses multiple transmitters and receivers. This design was insensitive to the helicopter engine noise, a major problem for previous designs.

We are also working on other active sensing systems. We have built a laser range finder based on a 1D CCD and triangulation and a laser range finder based on a 2D CCD and triangulation. The 2D system did not need

to be mechanically scanned.

We successfully achieved our major goal of flying an autonomous robot helicopter outdoors using these systems. We interfaced our onboard computer to a commercial compass, rate gyros, and a vertical gyro, in addition to the systems we developed.

We also adapted this technology for teaching. In a recent robotics and vision class we distributed 10 robot cars that use our infrared tracking capabilities for use by the students. The next version of this class will use our vision systems.

The students set ambitious goals for themselves, and worked full blast to achieve them!

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